Hydrology and the Ability of the Existing System to Meet the PISF

Generating Hydrologic Records

- USGS Stream Gage
- Concurrent Flow Measurements
- Regression between USGS and Concurrent Flows
- Use Regression Equation to Create RRepresentative Hydrographs

Form of Regression Equation

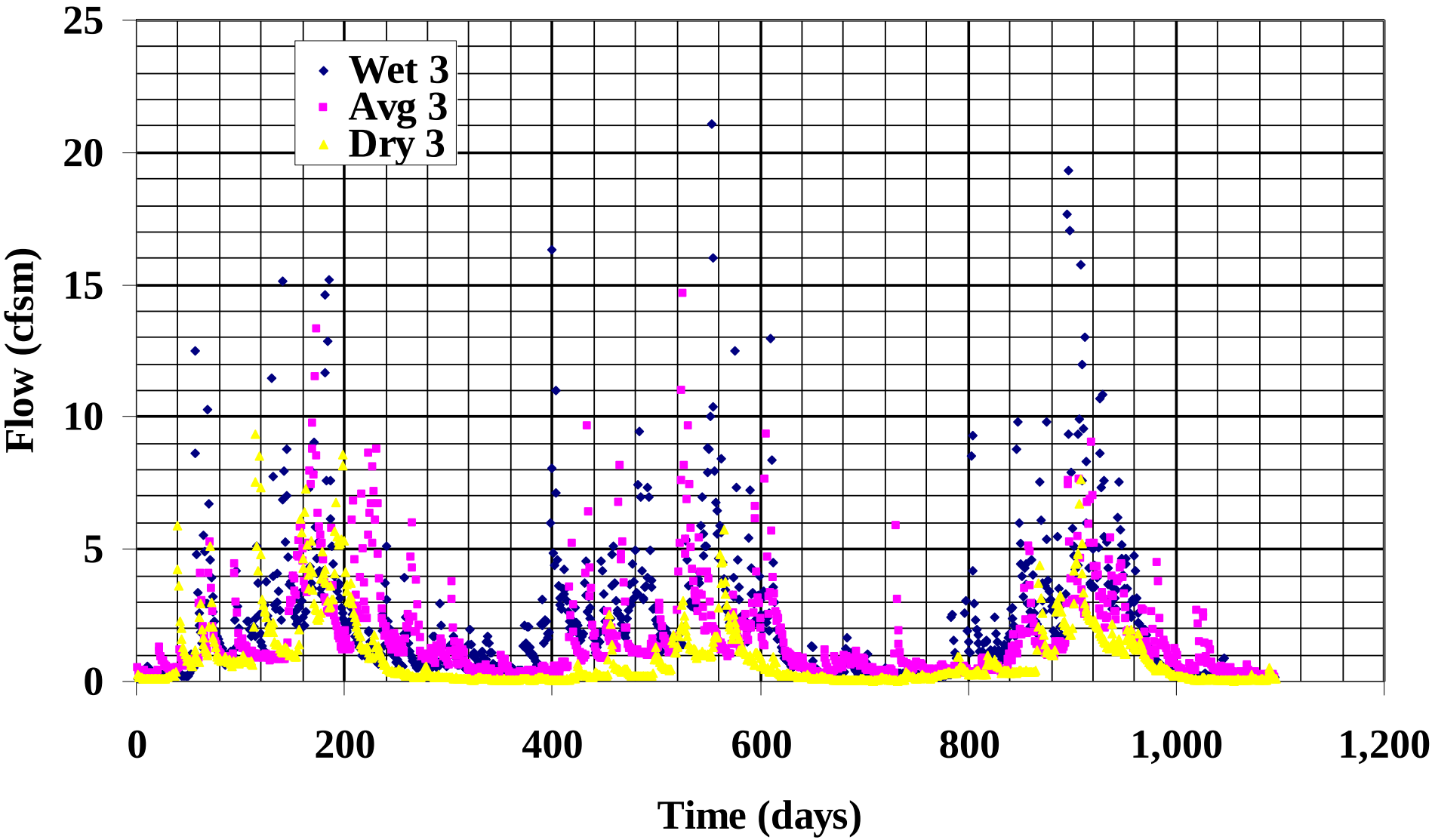
$$Q_{upstream} = a\,(Q_{USGS})^{b}$$

Note: Calibrated between 0.1 and 1 cfsm. Flows estimated higher than 1 cfsm are coarse.

Representative Hydrographs

- Last 5 years
- Wet 3 years
- Average 3 years
- Dry 3 years

Comparison of 3-Year Duration Souhegan River Hydrographs



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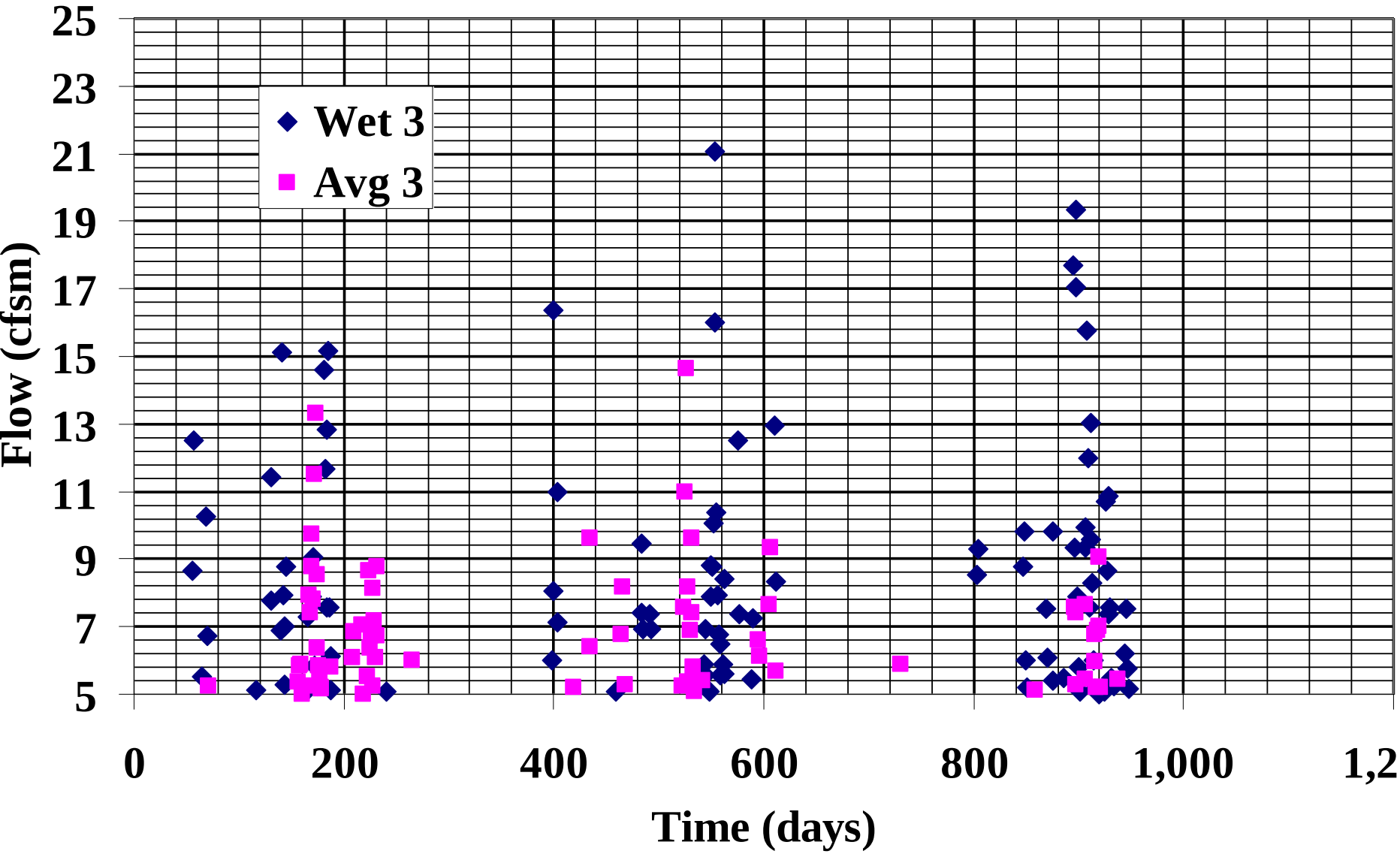

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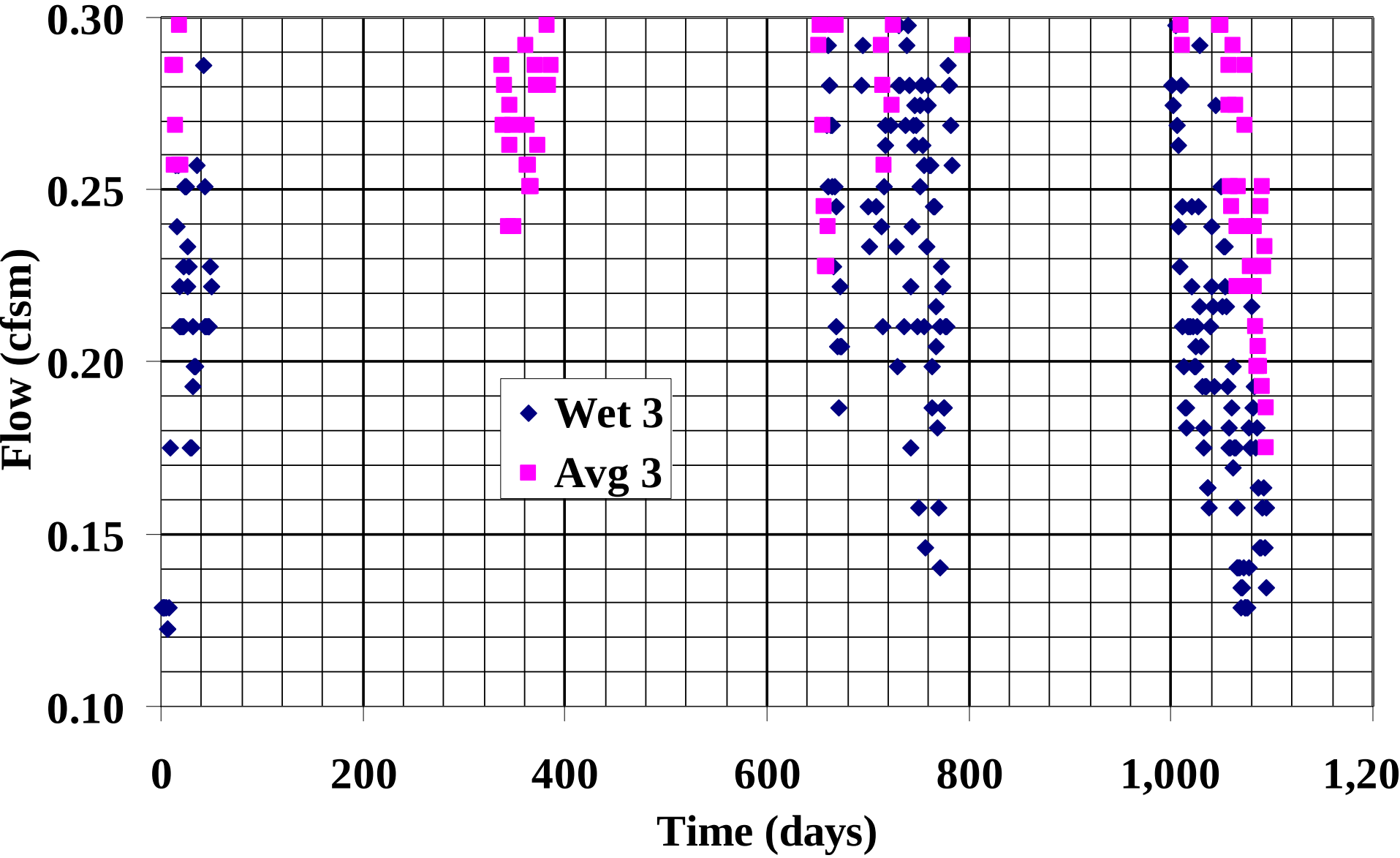


Recreation

4 cfsm in Reaches 1 and 2

Representative Hydrograph	Reach 1		Reach 2	
	Days	%	Days	%
Last five years	10	0.68	228	15.6
Wet three years	19	1.74	309	28.2
Average three years	4	0.37	198	18.1
Dry three years	0	0.00	94	8.6

Days and % of time that PISF is met

Fishing

Deferred to the PISF for fish habitat

Hydropower

0.7 cfsm in Reach 1 and 0.44 cfsm in Reach 3

Representative Hydrograph	Reach 1		Reach 3	
	Days	%	Days	%
Last five years	561	17.9	520	35.6
Wet three years	590	53.9	570	52.1
Average three years	479	43.7	624	57.0
Dry three years	267	24.4	351	32.0

Days and % of time that PISF is met

Pollution Abatement

0.1 cfsm for all Reaches

Representative Hydrograph	Reach 1		Reach 2		Reach 3		Reach 4	
	Days	%	Days	%	Days	%	Days	%
Last five years	28	1.9	204	14.0	165	11.3	187	12.2
Wet three years	0	0.0	111	10.1	50	4.6	72	6.6
Average three years	0	0.0	8	0.7	1	0.1	3	0.3
Dry three years	212	19.3	442	40.3	369	33.7	411	37.5

Days and % of time that PISF is NOT met

Representative Hydrograph	Reach 5		Reach 6		Reach 7		Reach 8	
	Days	%	Days	%	Days	%	Days	%
Last five years	187	12.8	163	11.2	163	11.2	33	2.3
Wet three years	72	6.6	50	4.6	50	4.6	0	0.0
Average three years	3	0.3	1	0.1	1	0.1	0	0.0
Dry three years	411	37.5	369	33.7	369	33.7	219	20.0

Days and % of time that PISF is NOT met

Water Supply

No recommended PISF

RTE: Fish, wildlife, vegetation, and natural/ecological communities

Wood Turtle

- Summer (June – September): flows less that 5.85 cfsm in Reaches 7 and 8
- Winter (December through February): flow should exceed the previous minimum November flow in Reaches 7 and 8

Summer

Representative Hydrograph	Reach 7		Reach 8	
	Days	%	Days	%
Last five years	4	0.3	0	0.0
Wet three years	4	0.4	0	0.0
Average three years	5	0.5	1	0.1
Dry three years	0	0.0	0	0.0

Days and % of time that PISF is NOT met

Winter

Representative Hydrograph	Reach 7		Reach 8	
	Days	%	Days	%
Last five years	67	18.4	67	18.4
Wet three years	14	1.3	14	1.3
Average three years	28	2.6	2	0.2
Dry three years	0	0.0.	0	0.0

Days and % of time that PISF is NOT met

Fowlers Toad

- Spring (March-May): Flow to exceed 2.95 cfsm, reaches 7 and 8
- Summer (May-September): Flow to exceed 0.1 cfsm, reaches 7 and 8

Representative Hydrograph	Reach 7		Reach 7	
	Years flow fills backwater	%	Days flow inadequate	%
Last five years	5	100	25	8.2
Wet three years	3	100	4	1.7
Average three years	3	100	0	0.0
Dry three years	2	66.7	123	54.0

Representative Hydrograph	Reach 8		Reach 8	
	Years flow fills backwater	%	Days flow inadequate	%
Last five years	5	100	26	8.6
Wet three years	3	100	4	1.7
Average three years	3	100	0	0.0
Dry three years	2	66.7	123	54.0

Pied-Billed Grebe

No Recommended PISF

Osprey
Common Loon

Deferred to the PISF for fish habitat

Long's Bitter Cress

No Recommended PISF

Wild Garlic
Wild Senna

- PISF is flood flow (2-year and 10-year)

Representative Hydrograph	2-year flood		10-year flood	
	Days	%	Days	%
Last five years	2	0.14	0	0.0
Wet three years	2	0.2	0	0.0
Average three years	0	0.0	0	0.0
Dry three years	0	0.0	0	0.0

Days and % of time that PISF is met

High Energy Riverbank (Twisted Sedge Low Riverbank and Fern Glade)

- Low flow Twisted PISF > 0.21 cfsm, reaches 1 and 2
- High flow PISF < 2.8 cfsm, reaches 1 and 2

Representative Hydrograph	Reach 1 High flow		Reach 1 Low flow	
	Days	%	Days	%
Last five years	45	3.1	257	17.6
Wet three years	67	6.1	151	13.8
Average three years	28	2.6	27	2.5
Dry three years	8	0.7	481	43.9

Days and % of time that PISF is NOT met

Representative Hydrograph	Reach 2 High flow		Reach 2 Low flow	
	Days	%	Days	%
Last five years	301	20.6	383	26.2
Wet three years	404	36.7	244	22.3
Average three years	258	23.6	137	12.5
Dry three years	134	12.2	548	50.0

Days and % of time that PISF is NOT met

Southern New England Floodplain Forest: Silver Maple Floodplain Forest

- 11.7 cfsm, reaches 6, 7, and 8

Representative Hydrograph	Reach 6,7		Reach 8	
	Days	%	Days	%
Last five years	8	0.55	50	3.4
Wet three years	16	1.5	70	6.4
Average three years	2	0.18	35	3.2
Dry three years	0	0.0	10	0.91

Days and % of time that PISF is met

Southern New England Floodplain Forest: Sycamore Floodplain Forest

- 18 cfsm, reach 4

Representative Hydrograph	Reach 4	
	Days	%
Last five years	35	2.4
Wet three years	50	4.6
Average three years	18	1.6
Dry three years	4	0.36

Days and % of time that PISF is met

Oxbow / Backwater Marsh

- Fill period in the spring (March - May): PISF > 2.5 cfsm, reaches 6, 7, and 8

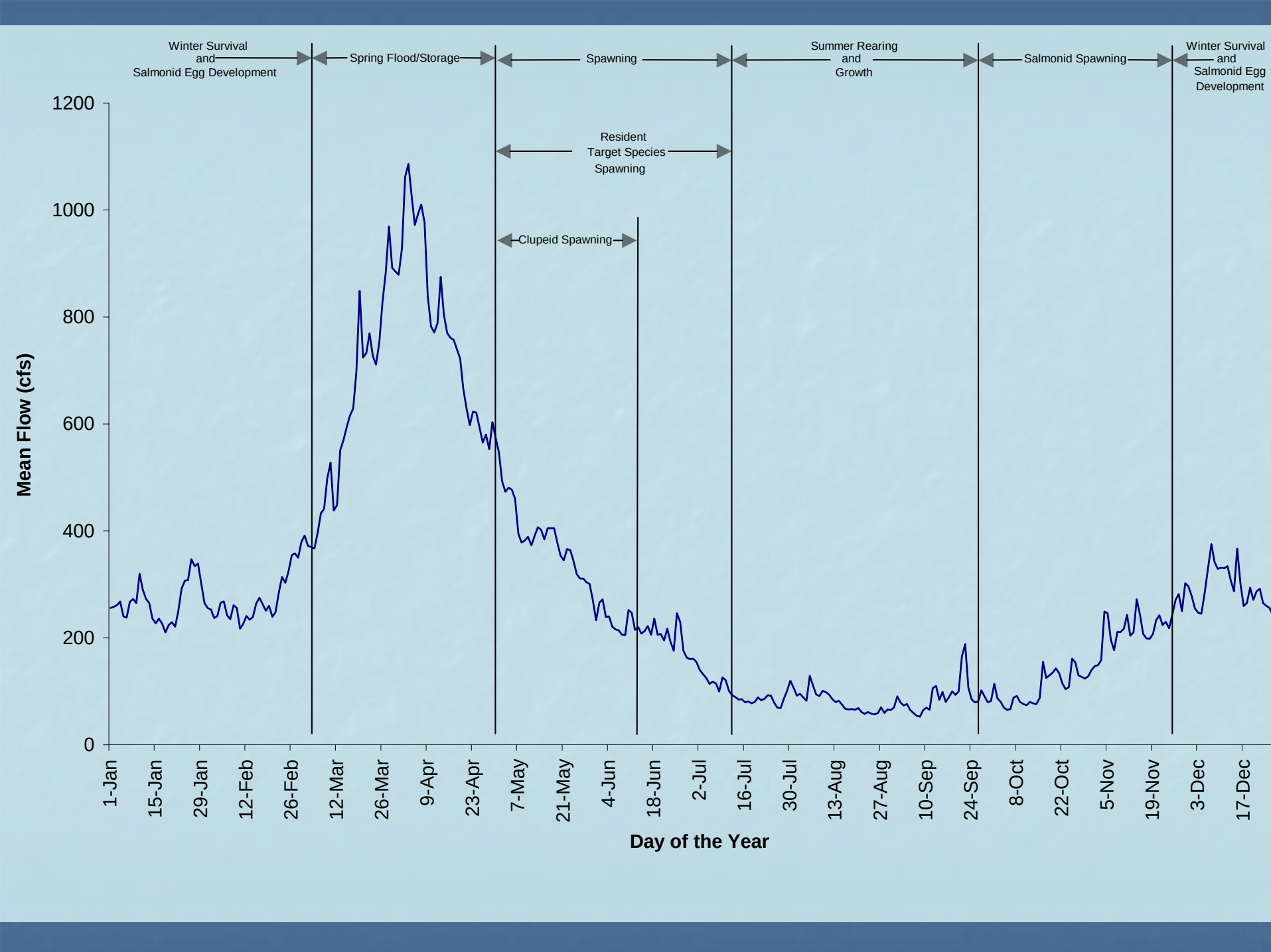
- Low maintenance flow in summer (May – September): PISF > 0.2 cfsm, reaches 6, 7, and 8

Representative Hydrograph	Reach 6,7 High Flow		Reach 6,7 Low Flow	
	Days	%	Days	%
Last five years	82	38.7	214	40.8
Wet three years	64	23.2	118	25.7
Average three years	90	32.6	60	13.1
Dry three years	166	60.1	318	69.3

Days and % of time that PISF is NOT met

Representative Hydrograph	Reach 8 High Flow		Reach 8 Low Flow	
	Days	%	Days	%
Last five years	97	45.7	128	24.4
Wet three years	91	33.0	56	12.2
Average three years	113	40.9	5	1.1
Dry three years	194	70.3	279	60.8

Days and % of time that PISF is NOT met


Winter Survival and Salmonid Egg Development
Spring Flood/Storage
Spawning
Summer Rearing and Growth
Salmonid Spawning
Winter Survival and Salmonid Egg Development
Resident Target Species Spawning
Clupeid Spawning
Mean Flow (cfs)
0
200
400
600
800
1000
1200
1-Jan
15-Jan
29-Jan
12-Feb
26-Feb
12-Mar
26-Mar
9-Apr
23-Apr
7-May
21-May
4-Jun
18-Jun
2-Jul
16-Jul
30-Jul
13-Aug
27-Aug
10-Sep
24-Sep
8-Oct
22-Oct
5-Nov
19-Nov
3-Dec
17-Dec
Day of the Year

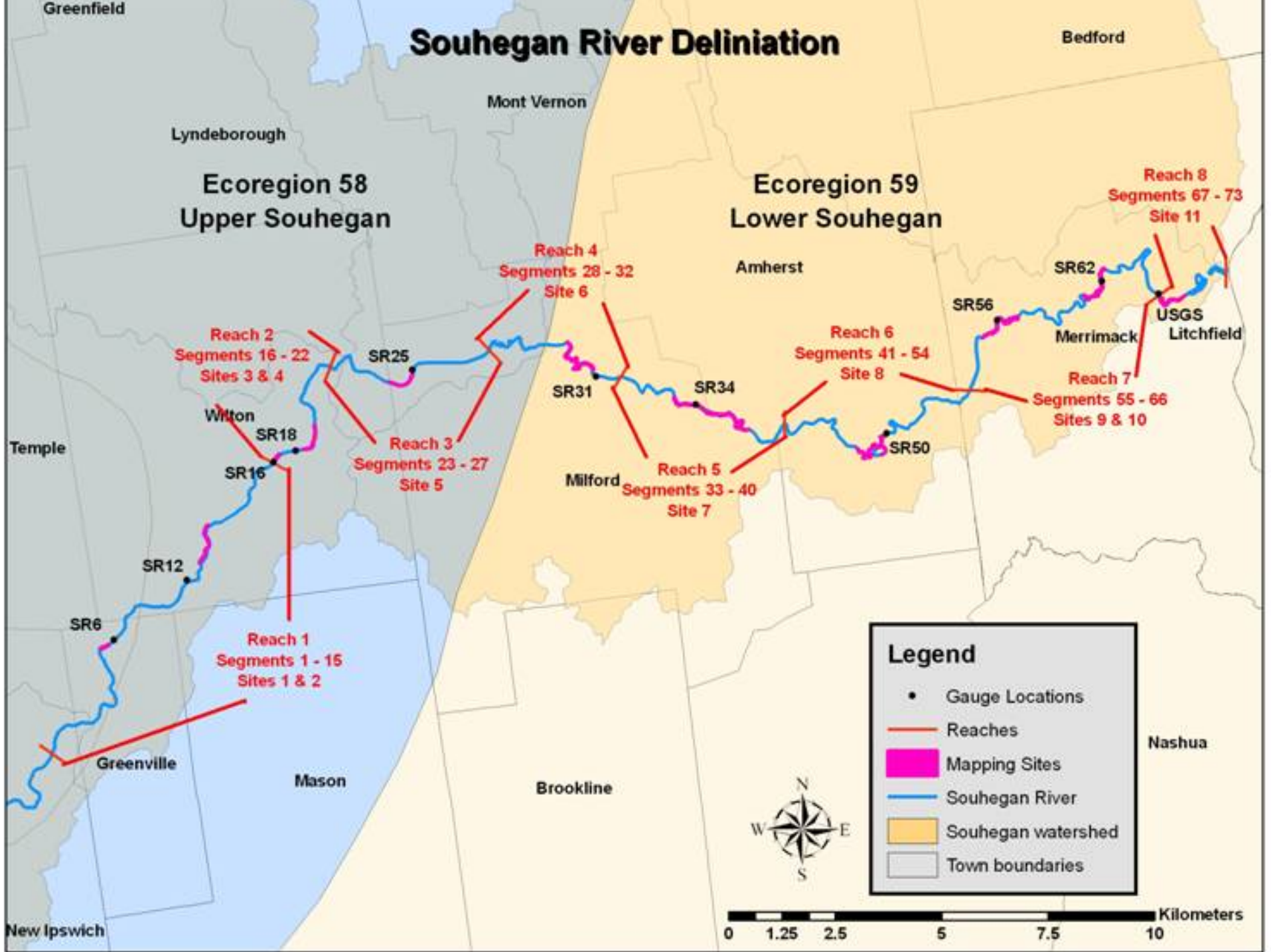
Bioperiods

- R&G: 16 July – 1 October
- Salmon Spawning: 1 October – 15 November
- Overwintering: 16 November – 28 February
- Spring Flood: 1 March – 30 April
- GRAF Spawning: 1 May – 15 July

Indicator	GRAF	**Condition met? And Frequency**	ATS	**Condition met? And Frequency**
Gauge (SR#)	6-12		31-34	
Watershed area (mi^2)	33.9		139	
Location	**Reach 1**		**Reach 5**	
Common habitat (% WA)	**19**		**6**	
Allowable duration under (days)	30	NO – 25%	30	NO – 50%
Catastrophic duration (days)	42	NO – 25%	45	NO – 25%
Corresponding flow present (cfsm)	0.4		0.34	

Indicator	GRAF	**Condition met? And Frequency**	ATS	**Condition met? And Frequency**
Gauge (SR#)	6-12		31-34	
Watershed area (mi^2)	33.9		139	
Location	**Reach 1**		**Reach 5**	
Critical habitat (% WA)	**10**		**5.2**	
Allowable duration under (days)	15	YES	17	NO – 25%
Catastrophic duration (days)	35	YES	20	NO – 25%
Corresponding flow present (cfsm)	0.16		0.15	

Indicator	GRAF	**Condition met? And Frequency**	ATS	**Condition met? And Frequency**
Gauge (SR#)	6-12		31-34	
Watershed area (mi^2)	33.9		139	
Location	**Reach 1**		**Reach 5**	
Rare habitat (% WA)	**7**		**5**	
Allowable duration under (days)	5	YES	5	NO – 100%
Catastrophic duration (days)	32	YES	10	NO – 50%
Corresponding flow (cfsm)	0.10		0.11	


Souhegan River Deliniation
Greenfield
Bedford
Mont Vernon
Lyndeborough
Ecoregion 58
Upper Souhegan
Ecoregion 59
Lower Souhegan
Amherst
Reach 8
Segments 67 - 73
Site 11
Reach 4
Segments 28 - 32
Site 6
SR62
SR56
USGS
Litchfield
Merrimack
Reach 2
Segments 16 - 22
Sites 3 & 4
SR25
Reach 6
Segments 41 - 54
Site 8
SR31
SR34
Reach 7
Segments 55 - 66
Sites 9 & 10
Wilton
SR18
Temple
SR16
Reach 3
Segments 23 - 27
Site 5
SR50
Milford
Reach 5
Segments 33 - 40
Site 7
SR12
SR6
Reach 1
Segments 1 - 15
Sites 1 & 2
Greenville
Mason
Brookline
Nashua
New Ipswich
Legend
Gauge Locations
Reaches
Mapping Sites
Souhegan River
Souhegan watershed
Town boundaries
N
W
E
S
0
1.25
2.5
5
7.5
10
Kilometers